ROTARY DRILLING

JACKING SYSTEMS AND RIG MOVING PROCEDURES

UNIT V • LESSON 4

A HOME STUDY COURSE ISSUED BY
PETROLEUM EXTENSION SERVICE
THE UNIVERSITY OF TEXAS AT AUSTIN

ROTARY DRILLING SERIES

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CHAPTER I
INTRODUCTION TO JACKING SYSTEMS

HISTORY

Since the early 1950's, the number of mobile offshore drilling units has steadily increased and today, more than 500 mobile rigs are in use. By mid-1976 about 150 rigs using jacking systems will operate in water depths up to 350 feet, with future working depths projected to be 400 feet or more. Figure 1 shows the history of jackup rigs from 1953-69.

The growth of the rig jacking system developed largely because of economic reasons. Offshore contractors realized that construction costs for a jacking system in 40 feet of water or deeper was considerably less than buying a submersible hull. Because both systems are bottom supported, drilling procedures for the two are similar, thus facilitating the transition from submersibles to jackups for crews experienced in offshore exploration.

The design for jacking systems and submersibles calls for the deck of the drilling platform to be stable and the wellhead to be set a fixed distance from the rotary. The wellhead and blowout preventers (BOP's) are usually above the water, and well pressure control procedures used at sea are identical to those on land. The advantage jacking systems hold is the dual capability of (1) drilling vertical holes for satellite wells served by a centrally located production platform and (2) moving close to a platform and drilling a number of wells that can be serviced and operated from that platform.

Jackup offshore drilling units evolved from Delong docks, barge hulls which were fitted with a number of columnar piles for legs. These docks were originally designed for use in remote areas where construction equipment was unavailable or where a dock had to be immediately installed. Notable examples of Delong docks include those on the Orinoco River in Venezuela, the "Texas Towers," built for radar posts off the U.S. Atlantic seaboard, and the docks at Camranh Bay, Vietnam.

The barge used in the Delong design is towed to the drilling site with the piles or legs drawn above the deck. Upon arriving the legs are lowered through holes in the hull until they touch the ocean bottom. By means of air-powered jacks and inflatable tubes which grip the columns while the jacks are stroking, the barge lifts itself out of the water and climbs its own legs to the desired elevation. Later design changes strengthened the legs, added more weight to the jacks, and improved the leg-gripping means. Cylindrical legs gave way to a truss-type construction, and mechanical slip grips and steel pins replaced the pneumatic grip used by Delong. Today, both electric and hydraulic jacking systems are available, as are independent-leg and mat-type units. The advantages inherent in both systems will be discussed in detail later.

Most leg designs on the jacking systems include large diameter cans, or spud tanks, to lessen leg penetration in soft bottoms. These cans were originally 10 to 20 feet in diameter and 15 to 30 feet high. Modern jackup units are now provided with leg footings 30 to 40 feet in diameter that have sloping tops to shed mud that may accumulate above the can. The footings are usually 10 to 20 feet high and can be pulled up into recesses in the hull, thereby obtaining minimum water drag when under tow.

CHAPTER II

INDEPENDENT—LEG DRILLING UNITS

GENERAL DESCRIPTION

Mobile offshore jacking rigs which employ cans or spud tanks are known as independent-leg drilling units. The tanks are fabricated to the lower end of the legs and allow 3500 to 5500 pounds per square foot of bearing load, depending on tank size and the weight of the drilling unit. Most cans contain water jets and piping for the washing of material which may accumulate on top of the can, and drain valves and vents to allow free-flooding capability. Figure 3 is an illustration of footing configurations for various tanks.

The independent-leg drilling unit performs best in firm, uneven bottoms such as coral, limestone, or boulders. In soft mud where penetration may be 60 feet maximum, the legs sometimes cannot obtain the necessary bearing to support the weight of the unit, and thus cannot sufficiently jack itself out of the water. Because of this, independent-leg drilling units are preloaded, that is, for stability they take on more weight than will actually be used during the drilling operation.

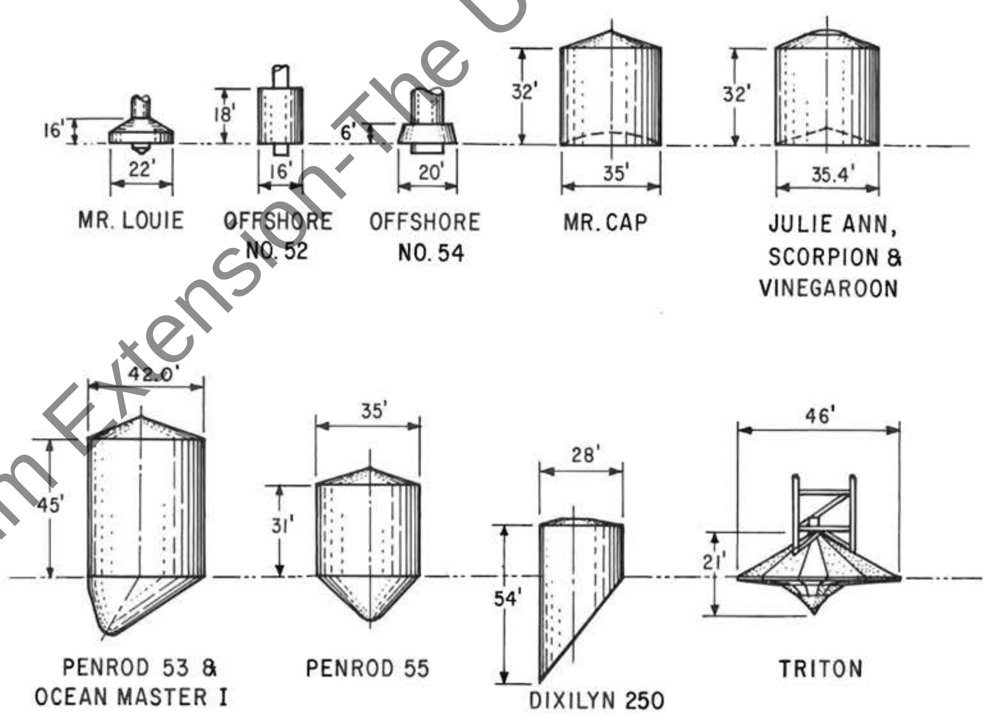

Figure 3. Footing configurations

CHAPTER III
MAT—TYPE DRILLING UNITS

GENERAL DESCRIPTION

Mat-type units, having a much larger area of contact with the sea floor than independent-leg units, operate with less bearing pressure on bottom, usually in the range of 500 to 600 pounds per square foot. This makes the mat-type unit the logical choice for soft mud, provided the bottom is more or less level. Mat-type units cannot work where the sea floor is erratic or covered with coral heads or boulders that would damage the bottom of the mat. These units are designed to operate with a bottom slope of 1° to 1.5°, and the legs cannot be adjusted for a sloping bottom as the independent-leg units can. If the sea floor is not level, it will be necessary to plumb the derrick by means of shims beneath the derrick footings so the crown will be vertically over the rotary. Mat-type units have more drag when under tow than independent-leg units; the usual towing speed of a mat-type unit is only two and three-fourths to three knots, about half the speed of the other type of drilling unit. Figure 19 shows a mat-type unit equipped with propulsion gear under tow.

Figure 19. Mat-type drilling unit under tow

CHAPTER IV
MOVING AND JACKING PROCEDURES

GENERAL INSTRUCTIONS

Independent-leg units and mat-type units are designed to withstand certain operating limits for (1) load capacities (2) afloat conditions and (3) elevated conditions. Any attempt to exceed these limits will jeopardize the safety of the crew and the unit. Jacking and moving procedures must take into account the capabilities of the unit when sitting on bottom, when afloat, or under tow. All personnel operating the unit's equipment should read the "Information and Operating Instruction Book" published by the manufacturer. This book gives specific instruction on the operation and maintenance of the unit's machinery.

Newly classed ABS jack up rigs all have emergency power sources. It is important to check the emergency power plant and all emergency systems at least once a week. Emergency repair supplies should be aboard the vessel at all times, and should be inspected periodically for quantity and condition.

PERSONNEL

The recommended number and type of personnel to jack down and move a drilling unit are as follows:

Position	*Task Description*
(1) Move Supervisor	In charge of operation
(1) Toolpusher	Assigns individual responsibilities; is jacking console operator
(1) Driller	Maintains proper clearances and communications with console operator
(1) Rig Engineer	Assigns electrician, mechanic, and motorman responsibilities and stands by to assist
(1) Electrician	Stands by below deck to take action to correct any electrical malfunction
(1) Mechanic	Stands by below deck to take action to correct any mechanical malfunction
(1) Welder	Assures that welding equipment is in good condition and that welding supplies are on board
(1) Derrickman (2) Motormen (6) Roughnecks or Roustabouts	Three men assigned to each yoke house

REMOVING UNIT FROM LOCATION

1) Switch fixed pins to "OUT" on all columns.

2) Lower yokes (raise platform) slightly with master jacking lever, monitoring rod end pressure gauges and "FIXED PIN OUT" light on all columns. If rod end pressure reaches 2500 psi on columns 1, 2, or 3 before the red

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